BRENNTAG
FOOD & NUTRITION

Sense the difference

Creating Functional Foods for Mainstream Sports Nutrition

Chicago Section IFT Suppliers' Symposium

Kim Shovelin, MPH, RD, LDN and Beeta Little, BS, MBA, PMP

November 6, 2019

INTRODUCTION

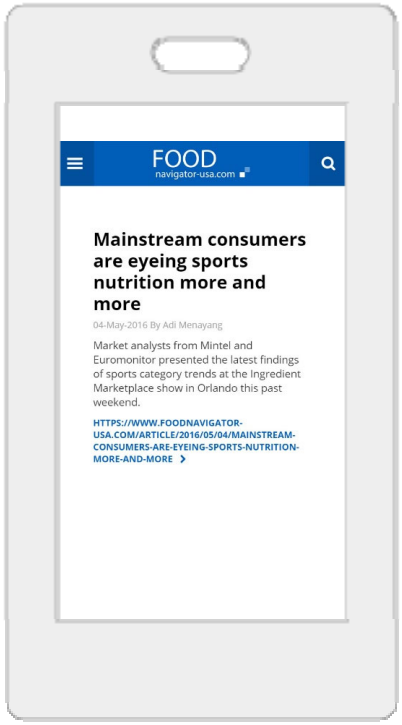
Our intent is to give you ideas… to show you what's changed and what hasn't…

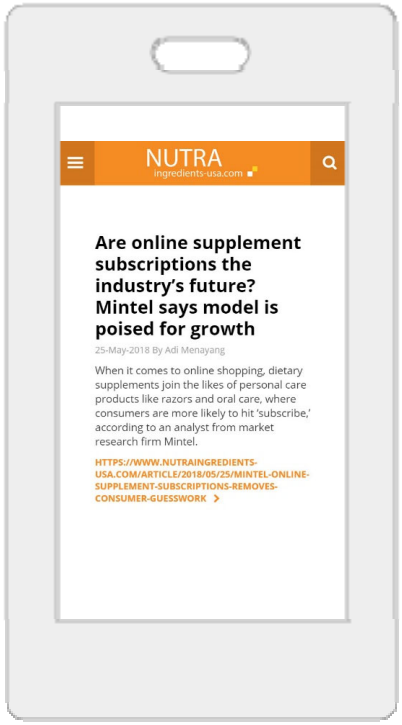
We will not cover regulatory or labeling ideas since they are very product specific.

We do intend to show you high level themes, how the supplement and nutrition market have become much broader than elite level athletes, and while there is still no magic bullet, there are ingredients with great promise.

SPORTS NUTRITION INTRODUCTION

Current headlines in the spotlight





Click the phone to open the full article

SPORTS NUTRITION INTRODUCTION

Current headlines in the spotlight

'Inadequate info sources' add to elite athletes' sparse supplement awareness, researchers say

By William Chu | July 23, 2019

"The team found that 64% or 337 athletes used dietary supplements with age, sex, type of sport, level of competition, and professionalism influencing the prevalence of dietary supplement use.

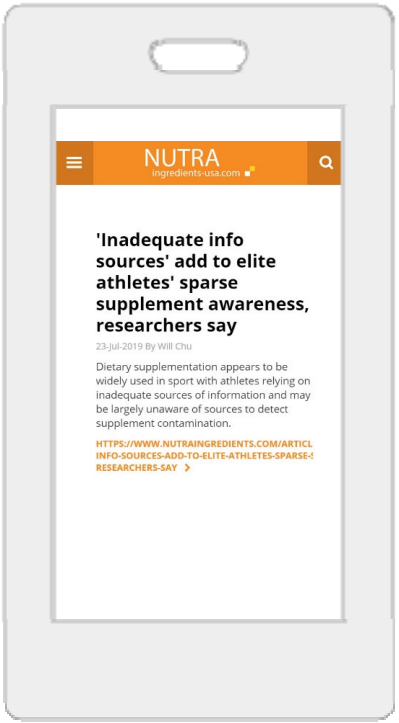
The most prevalent dietary supplement consumed was proteins (41% or 137 athletes), followed by amino acids/BCAA-based supplements (37%; 124).

Additionally, as per group of supplements according to IOC consensus, 18% of the supplements were rated as having a low level of scientific evidence (e.g., glutamine, HMB, L-carnitine, etc).

Most athletes (45%; 152) purchased dietary supplements in a store and 24%; 81) obtained them from a sponsor.

Most athletes also (42%; 141) reported a self-organisation of supplementation and did not consult with any professional.

Lastly, 81%; 273 of athletes consuming supplements did not know any platform to check supplement safety/quality."



Click the phone to open the full article

SPORTS NUTRITION INTRODUCTION

Current headlines in the spotlight

Mintel Blog

By Rick Miller | July 9, 2019

“The entire specialist nutrition sector is broadly categorized by functionality such as sports nutrition products for athletes. However, there is considerable crossover where products that were once specialist have evolved into a mainstream product – such as protein powders, bars and drinks.”

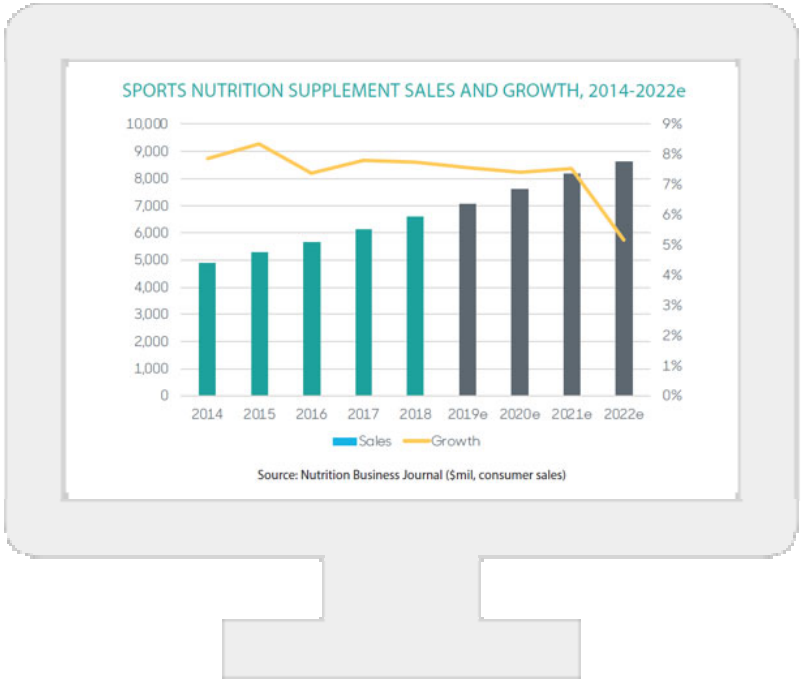
SPORTS NUTRITION INTRODUCTION

An overview of the market in 2019

Sports and Fitness Webinar

Food Navigator | September 25, 2019

- Whey is still the most popular protein, with 69% of products using whey
- Products are targeting a general audience vs. athletes



SPORTS NUTRITION INTRODUCTION

Mintel trending products

Energy Shot Drink

Allergen-Free Nutrition Bar

Chocolate Flavored Protein Supplement for Athletes

Fruit Punch Flavored Instantized BCCA Powder

Lime Flavored Hydrate Drink

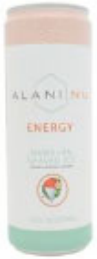
Watermelon Wave Dietary Supplement

Dark Chocolate Truffle Flavored Protein Almonds

Iced Tea-Lemonade Dietary Supplement

Blueberry Pomegranate Sports Drink

Hawaiian Shaved Ice Flavored Energy Drink



SPORTS NUTRITION INTRODUCTION

Much has changed in 20 years but a lot of the themes is still remain the same

High level themes we can conclude from the latest trends

- Categories continue to blur and more products include ingredients to please multiple types of athletes.
- The market has been crawling in this direction for 20 years.
- The supplement regulatory picture is cloudy at best.
- Today's consumers want plant-based ingredients.
- Protein and amino acids are still the most commonly used supplements for athletic performance.
- Consumers want a magic pill and keep trying new things.

INGREDIENTS/SUPPLEMENTS

What we'll cover today

- **Proteins**
- **Amino Acids**
- **Healthy Fats**
- **Curcumin and Coenzyme Q10**
- **Prebiotics and Probiotics**
- **Botanicals**

INGREDIENTS/SUPPLEMENTS

Proteins are changing and trending

- **Proteins**
- Amino Acids
- Healthy Fats – Omega 3, 6, CLA
- Curcumin and Coenzyme Q10
- Prebiotics and Probiotics
- Botanicals

PROTEINS

Proteins have different digestion and absorption rates

A protein blend with a mix of slow and fast acting proteins and a well balanced amino acid profile can set a brand apart. The quick and longer term effects are appealing to consumers.

Example – protein drinks to support muscle recovery and growth

Protein Type	Amount of Protein	Vegan	Allergen	Complete Protein	Flavor
Whey	30-95%	No	Yes	Yes	Dairy, Creamy, Not Sweet
Whey Hydrolysate	80-90%	No	Yes	Yes	Bitter
Casein	>90%	No	Yes	Yes	Dairy, Bland, Creamy
Milk	70-90%	No	Yes	Yes	Dairy, Sweet, Creamy
Collagen	80-90%	No	Some*	No	Bitter
Soy	50-90%	Yes	Yes	Yes	Nutty
Pea	50-85%	Yes	TBA	Yes	Beany, Bitter, Chalky
Rice	50-80%	Yes	No	No	Neutral, Chalky
Wheat	85-90%	Yes	Yes	No	Neutral
Pumpkin Seed	70%	Yes	No	No	Sweet, Mild, Slightly Roasted
Faba Bean	60-80%	Yes	No	Yes	Mild, Deflavoured Available
Lentil	55%	Yes	No	Yes	Strong, Nutty
Hemp	50%	Yes	No	No	Bitter, Strong
Water Lentil	50-65%	Yes	No	Yes	Green, Deflavoured Available
Sacha Inchi	60%	Yes	No	No	Mild, Nutty, Woody
Chia	35%	Yes	No	No	Mild, Nutty
Peanut Flour	34%	Yes	Yes	No	Peanuts
Cranberry	24.50%	Yes	No	No	Sour, Berry
Spirulina	50%	Yes	No	Yes	Green
Potato	40-45%	Yes	No	No	Neutral, Bitter
Algae Protein	40-60%	Yes	No	Yes	Green

INGREDIENTS/SUPPLEMENTS

Not much has changed with amino acids

- Proteins
- **Amino Acids**
- Healthy Fats – Omega 3, 6, CLA
- Curcumin and Coenzyme Q10
- Prebiotics and Probiotics
- Botanicals

AMINO ACIDS

Most important amino acids in sports nutrition – BCAA: Leucine, Isoleucine, Valine, Glutamine, and Arginine

TABLE 18–1 Nonessential and Essential Amino Acids for Humans and the Albino Rat

Nonessential	Conditionally essential*	Essential
Alanine	Arginine	Histidine
Asparagine	Cysteine	Isoleucine
Aspartate	Glutamine	Leucine
Glutamate	Glycine	Lysine
Serine	Proline	Methionine
	Tyrosine	Phenylalanine
		Threonine
		Tryptophan
		Valine

*Required to some degree in young, growing animals, and/or sometimes during illness.

Table 18-1
Lehninger Principles of Biochemistry, Fifth Edition

AMINO ACIDS

BCAA, Glutamine, and Arginine

BCAA

- **What is it?**
  - BCAA's (branch chained amino acids) contain 3 essential amino acids – leucine, isoleucine and valine. Said to aid in muscle protein synthesis and additional research is being done to determine other potential health benefits for chronic conditions.
- **Why is it used?**
  - BCAA's claim to improve muscle growth, decrease muscle soreness, reduce fatigue, prevent muscle breakdown
- **What type of customer would use this?**
  - Nutritional customers producing protein powders geared toward muscle enhancement and recovery (Optimum Nutrition iBCAA 5000)
  - Nutritional customers producing supplements and beverages geared towards athletes

GLUTAMINE

- **What is it?**
  - Glutamine is a non essential amino acid that aids in muscle production and reduces muscle breakdown.
- **Why is it used?**
  - It is said to be used to promote muscle production as well as improve immunity levels due to extended exercise regiments.
- **What type of customer would use this?**
  - Sports nutrition customers
  - Protein powder remanufacturers
  - Recovery drink manufacturers

BRENNTAG FOOD & NUTRITION

AMINO ACIDS

BCAA, Glutamine, and Arginine

ARGININE

- **What is it?**
  - Conditionally essential amino acid which is largely dependent on the health of an individual. It is found in many protein containing foods and can be synthesized by a healthy body from glutamine via citrulline
- **Why is it used?**
  - Arginine plays an important role in facilitating healthy blood flow – can be used as a vasodilator
  - Said to help maintain a healthy immune system
- **What type of customer would use this?**
  - Customers producing supplements for vasodilation
  - Protein and Vitamin powders

INGREDIENTS/SUPPLEMENTS

Healthy fats include omega 3, 6, and CLA

- Proteins
- Amino Acids
- **Healthy Fats**
- Curcumin and Coenzyme Q10
- Prebiotics and Probiotics
- Botanicals

BRENNTAG FOOD & NUTRITION

HEALTHY FATS

Athletes have long believed in the performance-enhancing benefits of omega-3 fatty acids

- Research supports that omega-3 supplementation improves the anabolic effect of training and counteracts muscle loss. Additionally, fish oil can help counteract the effects of delayed onset muscle soreness (DOMS).
- Omega 3's are available in a variety of oils and seeds. Chia contains highest levels of omega-3 FA by weight of any common food, more fiber than grain, and complete protein.

Nutrients. 2019 Jan; 11(1): 46. Omega-3 Polyunsaturated Fatty Acids: Benefits and Endpoints in Sport

Int J Sport Nutr Exerc Metab. 2013 Feb;23(1):83-96: Omega-3 polyunsaturated fatty acids in physical performance optimization

HEALTHY FATS

Conjugated Linoleic Acid (CLA) is a common omega-6 fatty acid

There are 28 different types of CLA, which are dependent on bond structure

- CLA may be one of the most comprehensively studied weight loss supplement in the world, with extensive studies
- Studies suggest that CLA has only modest effects on weight loss, must significant in the first 6 months
- Dosage and type are important

BASF's Tonalin® branded product is one of the more extensively studied products available

INGREDIENTS/SUPPLEMENTS

We have some new ideas for curcumin and coenzyme Q10

- Proteins
- Amino Acids
- Healthy Fats
- **Curcumin and Coenzyme Q10**
- Prebiotics and Probiotics
- Botanicals

CURCUMIN AND COENZYME Q10

Curcumin is an extract from turmeric

- Ingestion may reduce the extent of exercise-induced muscle damage
- It is antioxidant that can be capable of lowering inflammatory markers after exercise and of delaying the onset of sore muscles
- It may enhance muscular regeneration
- Curcumin, which is fat-soluble, is encapsulated by the water-soluble gamma-cyclodextrin, yielding a complex that forms a molecular dispersion in water. The human body is then able to absorb the curcumin much more readily.
- The bioavailability of curcumin complexed with gamma-cyclodextrins is 40-times that of the pure extract obtained from turmeric

CAVACURMIN® by WACKER is a free-flowing, dispersible curcumin powder

CURCUMIN AND COENZYME Q10

Coenzyme Q10 function is to efficiently transform ingested food into energy

It's a vitamin-like molecule present in every human cell

- Studies have linked the ingestion of coenzyme Q10 with enhanced performance and delayed onset of fatigue.
- Like curcumin, coenzyme Q10 is only sparingly soluble in water – and thus not readily bioavailable. However, that can be remedied by adopting the same strategy. Complexation with cyclodextrin not only enhances the stability of the sensitive substances, but also markedly improves absorption by the body; CAVAQ10® by Wacker

A human clinical trial by WACKER partner CycloChem in Japan showed that coenzyme-Q10-gamma-cyclodextrin complexes may protect muscle cells by functioning as free-radical scavengers and antioxidants.

INGREDIENTS/SUPPLEMENTS

We have some new ideas for prebiotics and probiotics

- Proteins
- Amino Acids
- Healthy Fats
- Curcumin and Coenzyme Q10
- **Prebiotics and Probiotics**
- Botanicals

PREBIOTICS AND PROBIOTICS

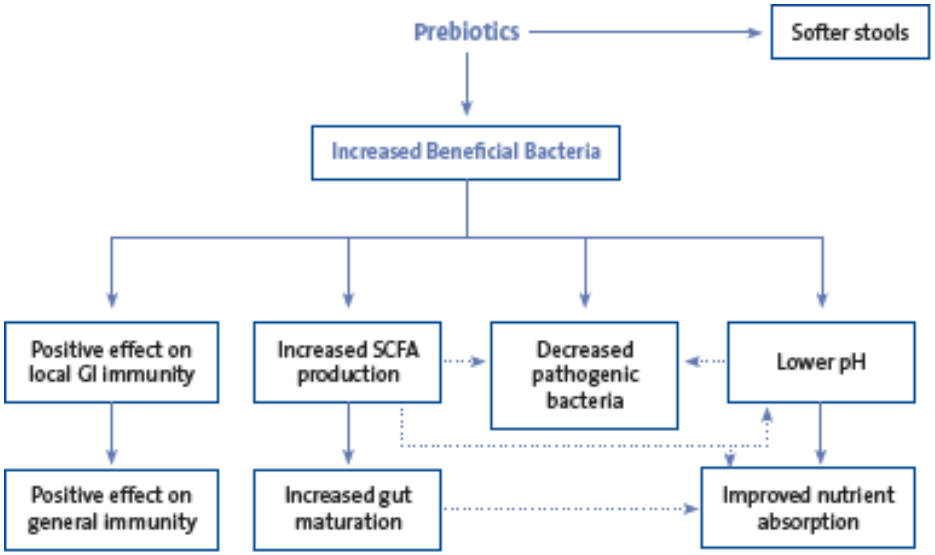
Prebiotics are food for the good bacteria in the gut, that help increase the population of probiotic bacteria

Gut microbes ferment complex dietary polysaccharides (like FOS) into short-chain fatty acids (SCFAs), which may be used as energy sources in the liver and muscle cells

- Stress during training and competition results in the release of stress hormones or sympathetic neurotransmitters that affect gut physiology.
- Good hydration and a functional intestinal barrier are vital for good sports performance
  - Both parameters are influenced by gut microbes

PREBIOTICS AND PROBIOTICS

Soluble fibers = prebiotics



PREBIOTICS AND PROBIOTICS

The roles of insoluble and soluble fiber in the gut

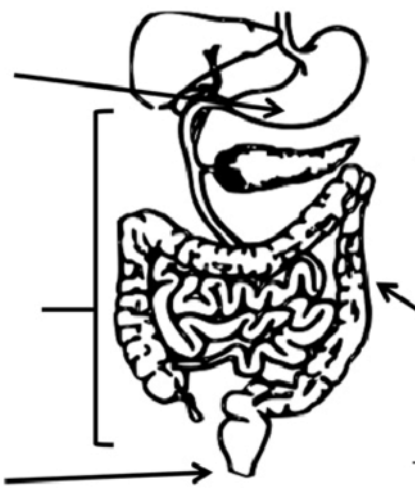
INSOLUBLE FIBER

Increase through water binding the volume of the stomach content
↓
Satiety ↑

Decreased transit time through gastro-intestinal tract

NON FERMENTABLE

Stool weight ↑
"bulking effect"



SOLUBLE FIBER

Soluble in water

Passage through stomach and small intestine
-No influence: unchanged arrival in colon
-If very viscous: delayed rate of digestion

FERMENTABLE

Dependent on:
- Substrate : physical and chemical properties
- Microbiota composition
- Transit time

Micriobial mass ↑
↓
Stool weight ↑

PREBIOTICS AND PROBIOTICS

For 1g of fructoligosaccharides, one may have to consume approximately…
7 bananas or 5 onions or 130 garlic cloves

PREBIOTICS AND PROBIOTICS

Changes in chain length of glucose and fructose creates the difference

Brief Comparison of scFOs with other FOS types

- Shorter the chain length, sweeter the taste of the ingredient
- Shorter the chain length, gets readily fermented by beneficial micro-organsims (ScFOS gets fermented in the early part of the colon 0-4 hrs, while LcFOS and Inulin at later part of the colon- more than 4 hrs)
- scFOS fermentation results in acute SCFA production over other FOS (Short chain fatty acids) that improve overall health of the body
- scFOS fermentation lowers the pH more of the gut environment more than the fermentation of other FOS
- scFOS has a higher prebiotic Index than Inulin

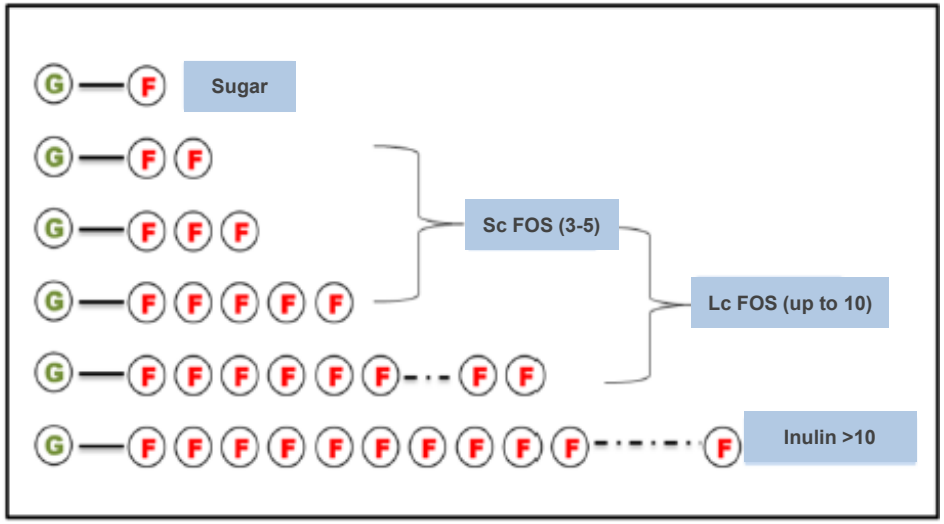


Figure 1: Polymer length of Sugar, Fructoligosaccharides, and Inulin

PREBIOTICS AND PROBIOTICS

Potential applications include bread, cookies, bars, milk beverages, powders, and more

The Benefit	
Good humectant	Traps moisture well, and allows for softness
Bake friendly	Stable up to 120°C (and even at higher temperatures for shorter exposure time)
Improves mouthfeel	Enhances texture; works synergistically with gums in milk drinks/beverages to improve viscosity
Acts as a binder	Holds ingredients together, aids in structure
Reduce or replace sugar	Partially replaces sugar*
Easy to use	100% soluble and readily dispersible

PREBIOTICS AND PROBIOTICS

Probiotics reside in a healthy intestinal tract but can be diminished by environmental stressors

Lactic acid-producing bacteria (LAB)

- *Lactobacillus* - small intestines
- *Bifidobacteria* - large intestines

Spore forming bacteria

- *Bacillus subtilis*
- *Bacillus coagulans*
- Resistant to pH & temperature

Yeast

- *Saccharomyces boulardii*

"Live microorganisms, which when administered in adequate amounts, confer a health benefit in the host."

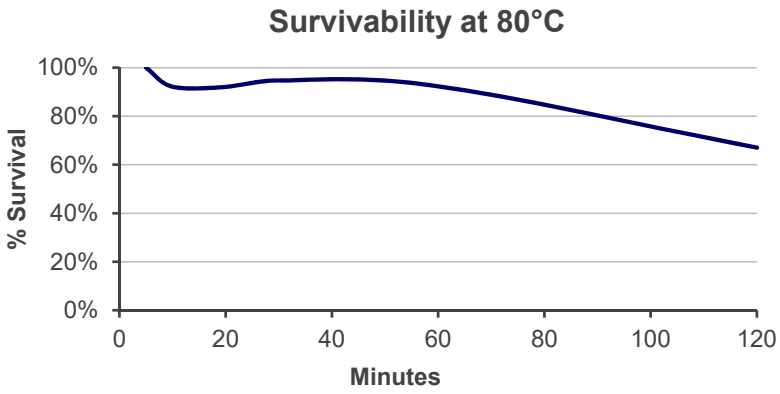
Food and Agriculture Organization of the United Nations and the World Health Organization

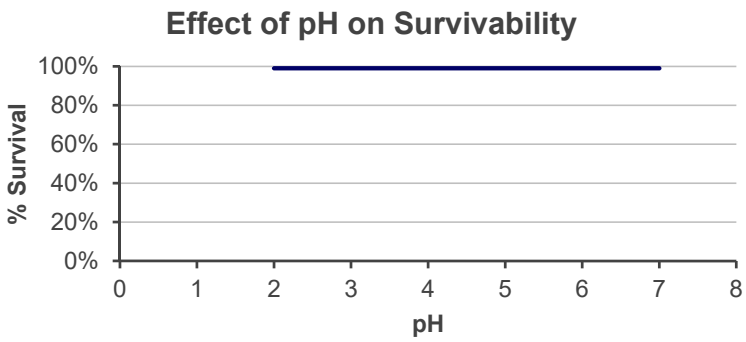
PREBIOTICS AND PROBIOTICS

Opti-Biome MB40 is a highly concentrated, unique probiotic strain of Bacillus subtilis

Opti-Biome MB40 is a non-GMO, spore-forming strain. It has a unique set of properties that make it an ideal candidate as a probiotic for a wide range of applications such as dietary supplements and foods typically associated with non-spore-forming probiotics such as Lactobacillus.

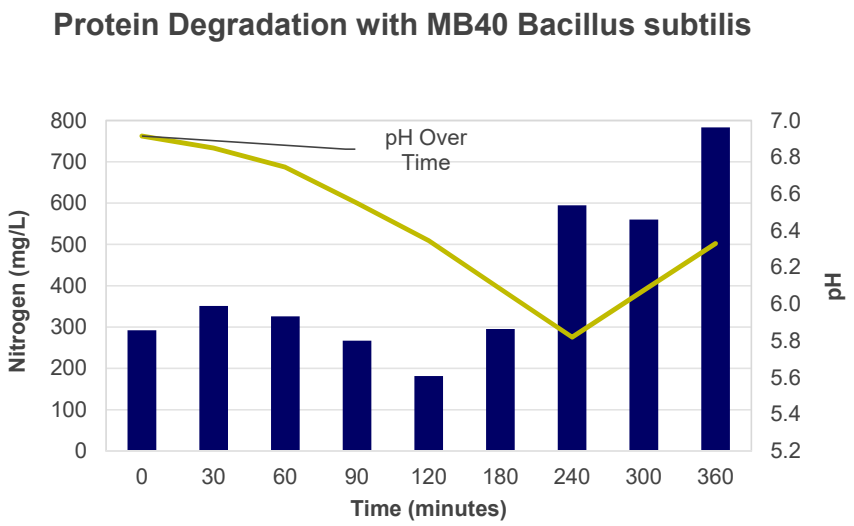
- Generally Recognized As Safe
- Can survive extreme manufacturing conditions extending the shelf life of the product without refrigeration





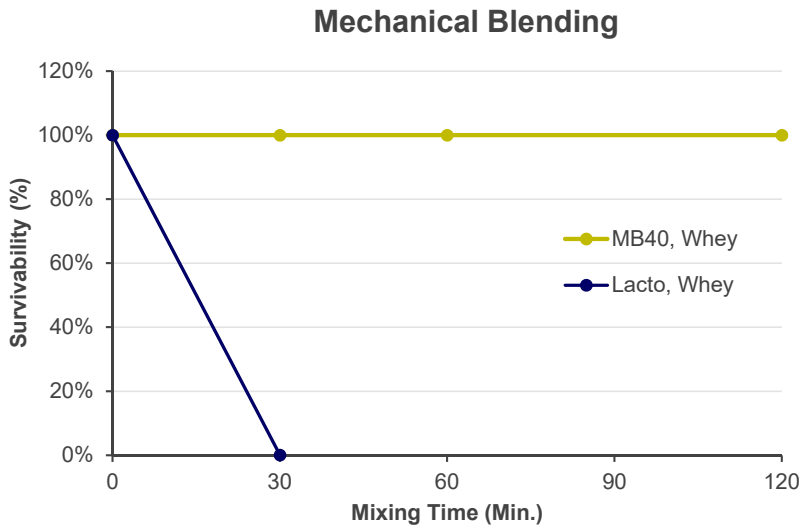
PREBIOTICS AND PROBIOTICS

Opti-Biome MB40 performance



Protein - Soy Meal

Spores held at pH 3 for 3 hrs, pH adjusted and growth monitored



Viability of OPTI-BIOME™ vs. Lactobacillus

INGREDIENTS/SUPPLEMENTS

We have some new ideas for botanicals, but there isn't much science

- Proteins
- Amino Acids
- Healthy Fats
- Curcumin and Coenzyme Q10
- Prebiotics and Probiotics
- **Botanicals**

BRENNTAG FOOD & NUTRITION

BOTANICALS

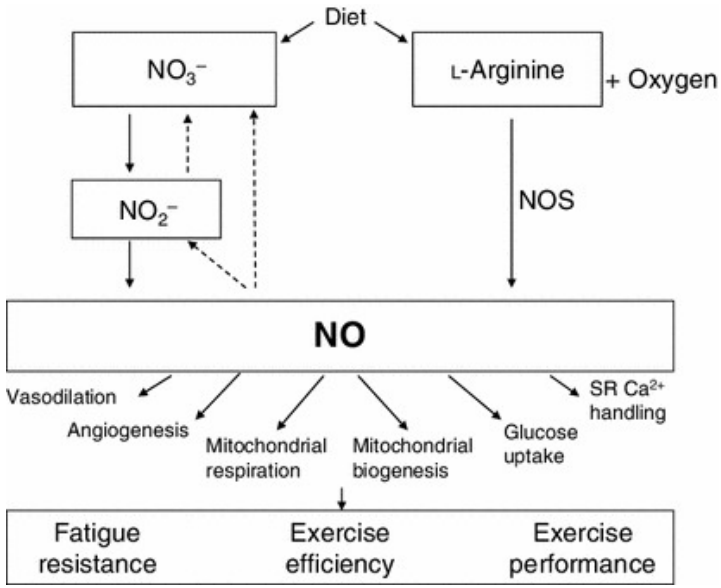
Different botanicals of interest

- Beets are high in nitric oxide. Nitric oxide leads to increased vasodilation, which leads to improved oxygen flow, as well as strengthening of muscle contraction
- Arugula extracts and powders are high in nitric oxide
- Guayusa powder is extracted from the holly tree, grows abundantly in LA, high in naturally occurring caffeine

BOTANICALS

Beets and arugula are good nitrate sources

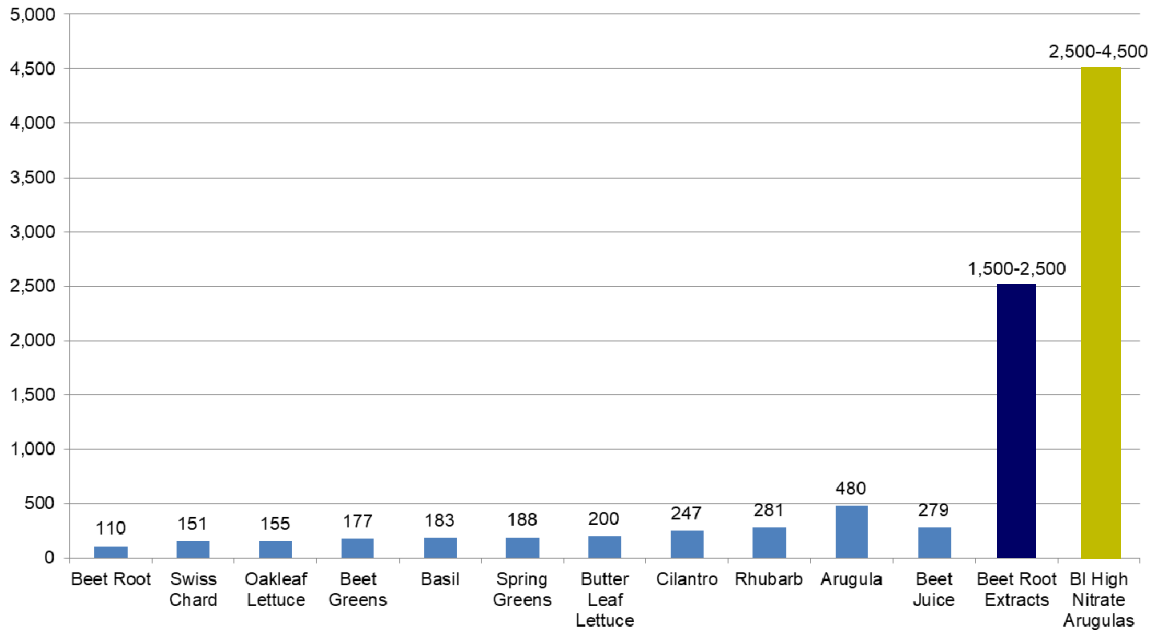
Nitric oxide leads to increased vasodilation, which leads to improved oxygen flow, as well as strengthening of muscle contraction



BRENNTAG FOOD & NUTRITION

BOTANICALS

Nitrates in vegetables (mg/100g)



BOTANICALS

Dietary Nitrate and Physical Performance by Andrew M. Jones et al. (2018)

Abstract

Nitric oxide (NO) plays a plethora of important roles in the human body. Insufficient production of NO (for example, during older age and in various disease conditions) can adversely impact health and physical performance. In addition to its endogenous production through the oxidation of l-arginine, NO can be formed nonenzymatically via the reduction of nitrate and nitrite, and the storage of these anions can be augmented by the consumption of nitrate-rich foodstuffs such as green leafy vegetables. Recent studies indicate that dietary nitrate supplementation, administered most commonly in the form of beetroot juice, can (a) improve muscle efficiency by reducing the O2 cost of submaximal exercise and thereby improve endurance exercise performance and (b) enhance skeletal muscle contractile function and thereby improve muscle power and sprint exercise performance. This review describes the physiological mechanisms potentially responsible for these effects, outlines the circumstances in which ergogenic effects are most likely to be evident, and discusses the effects of dietary nitrate supplementation on physical performance in a range of human populations.

BRENNTAG FOOD & NUTRITION

CREATING FUNCTIONAL FOODS FOR MAINSTREAM SPORTS NUTRITION

Any questions?

Brenntag North America

Food & Nutrition

Kim Shovelin, MPH, RD, LDN

Business Manager – Key Accounts

kshovelin@brenntag.com

(252) 327-0236

SENSE THE DIFFERENCE